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AUTHOR Jones, Barry W.
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ABSTRACT

The paper reports on a study of the ability of 93 hearing impaired students (10-18 years old) and 60 normal hearing students (8-10 years old) to recognize and comprehend grammatical "that complements" in English. Recognition and comprehension tasks are explained to have been administered to both groups, with deaf Ss receiving instructions through the total communication method. It is explained that statistical analysis reflected the effects of the early blocking of audition on the acquisition of English by deaf children, and that results for combined scores indicated that "that-complements" in object position were the easiest with "that-deleted complements", extra-posed complements and "that-complements" in subject position following in order of difficulty for both groups. Results were seen to indicate a need for the syntactic control of reading materials for hearing impaired students. (CL)

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# A STUDY OF THE RECOGNITION AND COMPREHENSION OF THAT-COMPLEMENTS

Barry W. Jones, Ph.D.
University of Miami
Coral Gables, Florida

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The purpose of this study was to compare hearing impaired and hearing subjects' abilities to recognize and comprehend grammatical that-complements in English. A large research project (Quigley, Wilbur, Power, Montanelli, and Steinkamp, 1976b) had been concerned with the abilities of hearing impaired subjects to work with the major syntactic structures of English. This work and that of Quigley, Wilbur, and Montanelli (1976a) investigated the acquisition of infinitival and gerundive complements and found them to be among the most difficult structures for deaf students. These studies did not, however, include that-complements since, in pilot testing, the structures associated with that-complements were too difficult for even the oldest deaf subjects. These structures appeared, however, more frequently in the Reading for Meaning series (McKee, Harrison, McCowen, Lehr, and Durr, 1966) than infinitival and gerundive complements combined.

Complementation is one of the three recursive processes in English. The recursive process is characterized by sentences which can either be conjoined or combined with other sentences. Thus, one can combine the following two sentences, John knew it. Mary broke the window., into one sentence, John knew that Mary broke the window. Complements are, therefore, embedded sentences which serve as noun phrases in either subject or object position as shown in Figure 1. Most, however, appear in object position.

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Rosenbaum (1967) and Lakoff (1968) have indicated that the English language has three complement types: for-to (infinitival) complements, POSS-ing (gerundive) complements, and that-complements (noun clauses). Examples of these complement types are shown in Figure 2. This study will, however, only be concerned with

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that-complements since they have not been the topic of prior investigations.

## Methods and Procedures

### Subjects

The subjects for this research consisted of 93 residential hearing impaired students between the ages of 10,0 and 18,11 years and 60 students with normal hearing between the ages of 8,0 and 10,11 years as of September 1, 1976. The hearing impaired subjects were students in a school in the Northeastern section of the United States and the hearing sample came from a public school in the Midwest. Each of the hearing-impaired subjects had to meet the following criteria:

1. A sensorineural hearing impairment of not less than 90 dB (ISO) in the better ear within the speech range (500, 1000, 2000 Hz);
2. The hearing impairment must have occurred before the age of two years;
3. An IQ of at least 80 on the performance scale of the WISC or WAIS, or some comparable test; and
4. No apparent disability other than hearing impairment.

These criteria were selected for two reasons. Controls one and two were selected to insure that the hearing-impaired subjects were equally deprived of exposure to oral language. Previous research (Lenneberg, 1967) has shown that limited experience with spoken language, as in the case of children deafened at the age of two-and-a-half or three years, may markedly influence their language learning. Controls three and four were designed to assure that any language deficit of the subjects could be attributed solely to the blocking of the aural input channel and not to other factors such as mental retardation or to the interaction of these other factors with deafness. Ninety-three hearing-impaired students in the Northeastern residential school met these criteria and were divided into three age groups as shown in Table 1. The

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mean IQ and hearing loss for each age group and the standard deviations for each are also shown in this table.

The 60 hearing subjects (ten boys and ten girls each at the ages of eight, nine, and ten years) were randomly selected from a population of 104 students in a Midwestern public school. Each of these subjects had to meet criterion three and have no apparent disabilities.

## Materials

A test of 100 items was developed to investigate aspects of _that_- complements among the subjects. Four aspects of _that_-complements were included in the investigation as shown in

Table 2. Each of these syntactic environments were included in

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two tasks--a Recognition Task and a Comprehension Task.

Recognition Task. Chromsky (1957, 1965) has long recognized the importance of having adult informants distinguish between grammatical and nongrammatical sentences. Traditionally, the sentences have been presented to the subjects orally. Menyuk (1969) has also suggested that this technique can be used for psycholinguistic studies with children beginning at the kindergarten level. The Recognition Task consists of an adaptation of this technique--the subjects were asked to select grammatical sequences in their written forms. This adaptation to written form was utilized to insure that the method of presentation would not be affected by the subjects' hearing status. An example of the Recognition items is shown in Figure 3.

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Comprehension Task. Of the two tasks being investigated in this study, the comprehension task was more fundamental. Individuals may be called upon to make judgments of grammticality on selected occasions and for specific purposes, but they must utilize their comprehension skills daily. For students in school it is especially important that they be able to understand the materials in their textbooks. Quigley, et al. (1976b) performed a linguistic analysis of the Reading for Meaning series (McKee, et al., 1966)

and found a wide disparity between his deaf subjects' knowledge of specific syntactic structures and the appearance of those structures in the readers. The importance of studying the subjects' comprehension of that-complements is further enhanced by the observation that this structure in its syntactic environments occurred more frequently in the above named reading series than the other two forms of complementation combined (for-to complements and POSS-ing complements).

The alternatives for each item consisted of four grammatical simple sentences produced by varying lexical items from the stimulus sentence. Research by Power (1971), Power and Quigley (1973), and Quigley, et al. (1976b) has indicated the tendency of deaf students to impose a subject-verb-object interpretation of sentences. It is possible, therefore, that the subjects would give a correct response to the item shown in Figure 4 for the

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wrong reason. This tendency to impose a subject-verb-object order was controlled for by varying the use of animate and inanimate noun phrases in two of the four syntactic environments: that-complements in subject position (That Jim broke the window disappointed Father) and that-deleted complements (Bill learned a tree fell on the girl).

## Procedures

The tasks in each of the above environments were administered to the subjects in one session which lasted approximately one hour.

The deaf subjects were tested in groups which ranged in size from 12 to 16 students and the hearing children were tested within their regular classroom environments by their teachers under the supervision of the investigator.

Instructions to the deaf children were given by the "Simultaneous Method" of communication. This method is characterized by the use of signs or fingerspelling occurring simultaneously with speech. The instructions to the hearing subjects were presented orally. None of the subjects experienced any difficulty with the instructions. Since the test was constructed to assess the students' abilities to recognize and comprehend syntactic structures, any words which proved to be difficult for the subjects were explained.

Statistical Analyses

Two types of statistical analyses were used in this study. The first consisted of a detailed analysis of the test items using the Mermac Test and Questionnaire Analysis Programs (Costa, 1971) available for use on the IBM System/360 at the University of Illinois. The Test Analysis and Questionnaire Package provided measures of central tendency, the standard deviation, reliability coefficients (Kuder-Richardson 20 and Kuder-Richardson 21), the standard error of measurement, and the possible and obtained ranges of scores for the overall test, each task, and each subtest. These were also computed for each age group.

The second type of statistical analysis consisted of analyses of variance to determine the significance of hearing status differences, age differences and differences between tasks and subtests.

Interaction effects were analyzed by tests for simple main effects (Kirk, 1968) and, where appropriate, Scheffé contrasts between pairs of means (Glass and Stanley, 1970). An alpha level of $p < .05$ was accepted for all tests.

## Results

The means and standard deviations for the Recognition and Comprehension tasks and the Total Test Score for the deaf and hearing subjects are presented in Table 3. The results indicate

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that the hearing subjects performed significantly better ($p < .001$) than the hearing impaired subjects on both tasks and, hence, the total test score. These findings confirm those of Quigley, et al. (1976a and 1976b) and reflect the effects of the early blocking of the sense of audition on the acquisition of English. This effect is also seen in the fact that the youngest hearing subjects scored higher than the oldest hearing impaired subjects on both tasks and, therefore, the total test. Tables 4 and 5 present the

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means and standard deviations for both groups of subjects on the Recognition and Comprehension tasks and the combined scores for each of the four syntactic environments investigated. The results for the combined scores indicate that <u>that</u>-complements in object position were the easiest with <u>that</u>-deleted complements, extra-

posed complements and that-complements in subject position following in order of difficulty for both groups. Although there were variations in this order of difficulty between tasks it should be noted that that-complements in object position were easier than that-complements in subject position on both tasks ($p < .01$). This finding is consistent with those of other researchers (Limber, 1973, Menyuk, 1969, and Quigley, et al. 1976a) who have investigated other aspects of complementation with hearing students. None of the above investigators reported the production of complements in subject position by the children in the studies.

As mentioned previously, the subject's performances on the Comprehension Task were of primary concern. Although the Comprehension Task was significantly easier ($p < .01$) than the Recognition Task for only that-complements in subject position and extraposed that-complements, the only syntactic environment in which the comprehension score was actually lower than the recognition score was that-deleted complements. Power and Quigley (1973) found that the word, by, served as a marker for sentences written in the passive voice. Perhaps the word, that, serves as a marker for the comprehension of that-complements in object position. In the sentence, Jim knew Mary was late, the reader could employ one of two subject-verb-object strategies to interpret the sentence. Thus, the primary idea of the sentence could be interpreted as either Jim knew Mary or Mary was late. However, in the sentence, Jim knew that Mary was late, that could possibly serve as a marker to identify the last clause as the object of the sentence.

An analysis of the distractors selected by the subjects indicated that the mean percentage of deaf subjects responding to either the first or last clause of that-deleted complements for the Comprehension Task was 76%. Of that 76%, 32% selected the first clause as the correct one whereas 44% correctly selected the last clause. It would appear, therefore, that a large percentage of the subjects were using one of two subject-verb-object strategies to interpret these sentences. Bever (1970) postulated that the first noun-verb-(noun) clause would be identified as the main clause, unless the verb was marked as subordinate. Perhaps many deaf students have difficulty understanding the roles of different verbs in complex sentences and cannot distinguish between main and subordinate clauses. This could lead to confusion as subjects attempted to identify which clause expressed the primary meaning of the sentence. This possible phenomenon is suggested as one area for further research.

## Conclusions

Two basic assumptions guided the selection of hypotheses for this study. First, it was assumed that the hearing subjects would perform better than the deaf subjects. Researchers investigating the language problems of deaf children since the early 20th century have consistently found that hearing students perform better than deaf students on tasks requiring a knowledge of English. This study was no exception.

Second, it was assumed that that-complements in object position and the structure derived from it, that-deleted complements,

would be easier than that-complements in subject position and its derivative, extraposed that-complements. There were variations within the total range of possibilities but the findings did generally indicate that that-complements in object position were easier than that-complements in subject position.

The results of this study clearly indicate a need for the syntactic control of reading materials for hearing impaired students. The deaf subjects in the sample had very little knowledge of that-complements. These structures do appear, however, quite frequently in materials they are expected to comprehend.

The results also indicate that teachers of hearing impaired students should make more of a concentrated effort to teach these structures which are frequently ignored. Methods and materials could be developed which should aid in the acquisition of these structures by deaf children.

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Subject Position--That Mary broke the window disappointed John.

Object Position--John knew that Mary broke the window.

Figure 1. Examples of Complements in Subject and Object Positions

For-To--I said for you to come.

POSS-ing--We discussed Bill's leaving the party.

That--I believe that we are going to town.

Figure 2. Examples of Complement Types

A. The boys knew the dog was lost.

B. The boys knowing the dog was lost.

C. The boys knew for the dog was lost.

D. The boys knew to the dog was lost.

Figure 3. Examples of Recognition Items

The girl knows the boy loves trucks.

A. The girl knows the boy.

B. The girl loves trucks.

C. The girl loves the boy.

D. The boy loves trucks.

Figure 4. Example of Comprehension Items

Table 1

Mean IQ and Hearing Loss by Age for the Hearing Impaired Subjects

| Age | N | IQ | | Hearing Loss | |
|---|---|---|---|---|---|
| | | $\bar{X}$ | SD | $\bar{X}$ | SD |
| 10-12 years | 40 | 99.8 | 10.8 | 100.9 dB | 5.6 |
| 13-15 years | 33 | 105.4 | 11.1 | 102.3 dB | 6.3 |
| 16-18 years | 20 | 103.8 | 9.6 | 102.9 dB | 6.5 |

Table 2

Examples of the Four Syntactic Environments

| Syntactic Environment | Example |
|---|---|
| 1. That-complements--object position | 1. Bill thought that Mary broke the window. |
| 2. That-complements--subject position | 2. That John lost the race surprised Andy. |
| 3. That-deleted complements | 3. Bill thought Mary broke the window. |
| 4. Extraposed that-complements | 4. It surprised Andy that John lost the race. |

Table 3

Percentage Group Means and Standard Deviations by Age on the Two Tasks and the Total Test Score

| | Deaf | | | Hearing | | |
|---|---|---|---|---|---|---|
| Task | Age | $\bar{X}$% | SD% | Age | $\bar{X}$% | SD% |
| Recognition | 10-12 | 28.4 | 13.2 | 8 | 67.8 | 13.5 |
| Score | 13-15 | 46.2 | 16.0 | 9 | 71.5 | 14.0 |
| | 16-18 | 45.3 | 21.3 | 10 | 70.0 | 15.3 |
| Across Ages | | 38.4 | 18.2 | | 69.0 | 14.1 |
| Comprehension | 10-12 | 44.6 | 19.2 | 8 | 84.0 | 13.2 |
| Score | 13-15 | 58.6 | 27.1 | 9 | 88.0 | 13.3 |
| | 16-18 | 50.0 | 28.8 | 10 | 87.0 | 19.8 |
| Across Ages | | 50.7 | 24.9 | | 86.6 | 15.6 |
| Total Test | 10-12 | 36.5 | 12.7 | 8 | 75.9 | 11.0 |
| Score | 13-15 | 52.4 | 18.1 | 9 | 80.1 | 11.9 |
| | 16-18 | 47.7 | 19.4 | 10 | 78.0 | 15.1 |
| Across Ages | | 44.5 | 16.7 | | 78.0 | 12.7 |

Table 4

Percentage Group Means and Standard Deviations by Age on Each Subtest by Task for the Deaf Subjects

| Subtest | Age | Recognition $\bar{X}$% | Recognition SD% | Comprehension $\bar{X}$% | Comprehension SD% | Combined $\bar{X}$% |
|---|---|---|---|---|---|---|
| That-complements | 10-12 | 34.8 | 27.9 | 47.2 | 29.0 | 41.0 |
| object position | 13-15 | 67.9 | 29.3 | 62.4 | 31.5 | 65.2 |
| | 16-18 | 66.3 | 31.3 | 55.5 | 34.4 | 60.9 |
| Across Ages | | 53.0 | 33.1 | 54.4 | 31.5 | 53.7 |
| That-deleted | 10-12 | 35.1 | 23.6 | 35.0 | 24.0 | 35.1 |
| complements | 13-15 | 58.2 | 24.6 | 53.0 | 29.7 | 55.8 |
| | 16-18 | 57.3 | 26.9 | 45.5 | 29.6 | 51.4 |
| Across Ages | | 48.1 | 26.9 | 43.8 | 28.3 | 45.9 |
| Extraposed | 10-12 | 19.5 | 14.1 | 50.0 | 31.8 | 34.7 |
| complements | 13-15 | 26.3 | 16.7 | 62.7 | 35.6 | 44.5 |
| | 16-18 | 29.6 | 21.5 | 52.5 | 39.2 | 41.1 |
| Across Ages | | 24.1 | 17.2 | 55.0 | 39.4 | 39.6 |
| That-complements | 10-12 | 24.3 | 21.7 | 46.3 | 23.6 | 35.3 |
| subject position | 13-15 | 32.7 | 24.2 | 56.1 | 33.1 | 44.4 |
| | 16-18 | 28.0 | 32.9 | 46.5 | 31.5 | 37.3 |
| Across Ages | | 28.1 | 25.0 | 49.8 | 29.0 | 38.9 |
| Total Task Score | | 38.4 | 18.2 | 50.7 | 24.9 | 44.5 |

Table 5

Percentage Group Means and Standard Deviations by Age on Each Subtest by Task for the Hearing Subjects

| Subtest | Age | Recognition $\bar{X}$% | Recognition SD% | Comprehension $\bar{X}$% | Comprehension SD% | Combined $\bar{X}$% |
|---|---|---|---|---|---|---|
| That-complements | 8 | 84.3 | 14.7 | 91.0 | 11.7 | 87.6 |
| object position | 9 | 88.7 | 10.2 | 90.5 | 14.0 | 89.6 |
| | 10 | 84.3 | 20.5 | 89.5 | 18.5 | 86.9 |
| Across Ages | | 85.8 | 15.6 | 90.3 | 14.7 | 88.0 |
| That-deleted | 8 | 84.0 | 12.7 | 85.5 | 16.4 | 84.7 |
| complements | 9 | 81.7 | 15.6 | 92.0 | 11.1 | 86.8 |
| | 10 | 85.0 | 15.3 | 88.5 | 22.3 | 86.7 |
| Across Ages | | 83.5 | 14.4 | 88.7 | 17.0 | 86.1 |
| Extraposed | 8 | 69.7 | 23.5 | 86.5 | 15.7 | 78.1 |
| complements | 9 | 76.0 | 17.1 | 91.0 | 17.1 | 83.5 |
| | 10 | 75.0 | 17.4 | 90.0 | 17.5 | 82.5 |
| Across Ages | | 73.5 | 19.4 | 89.0 | 16.6 | 81.2 |
| That-complements | 8 | 33.3 | 24.4 | 73.5 | 20.0 | 53.4 |
| subject position | 9 | 39.7 | 27.6 | 81.5 | 24.0 | 60.6 |
| | 10 | 36.7 | 25.0 | 80.0 | 29.6 | 58.3 |
| Across Ages | | 36.5 | 25.4 | 78.3 | 24.8 | 57.4 |
| Total Task Score | | 69.1 | 17.9 | 86.5 | 20.4 | 78.2 |